(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 048 914 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.04.2009 Bulletin 2009/16

(51) Int Cl.:
H05B 6/36 *(2006.01)* ***H05B 6/12*** *(2006.01)*

(21) Application number: **07118254.7**

(22) Date of filing: **10.10.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(71) Applicant: **LG Electronics Inc.**
Yeongdeungpo-gu
Seoul 150-721 (KR)

(72) Inventors:
- **Oh, Doo Yong**
  Seoul 152-848 (KR)
- **Ryu, Seung Hee**
  Gyeonggi-do (KR)
- **Park, Byeong Wook**
  Gyeonggi-do (KR)

(74) Representative: **Cabinet Plasseraud**
52, rue de la Victoire
75440 Paris Cedex 09 (FR)

Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **A cooking device having an induction heating element**

(57) An induction heater may comprise a base, a plurality of first solids of ferromagnetic or ferrimagnetic material and a first coil having a plurality of wire windings. The solids have a prescribed shape and are provided to have a prescribed arrangement on the base, and the first coil has a prescribed shape, and the first coil is provided over at least portions of the plurality of solids. A second coil may be provided within the first coil and spaced apart from the first coil. The second coil cross over at least portions of the plurality of first solids. A plurality of second solids of ferromagnetic or ferrimagnetic material may be formed parallel to each other, and contact at least one of the first solids. The induction heater may also include a plurality of third solids of ferromagnetic or ferrimagnetic material, a third coil having a plurality of wire windings and a fourth coil. The third solids, the third coil and the fourth coil have the same shape and arrangement as the first solids, the first coil and the second coil, respectively, and the first and third coils are separated from each other by a prescribed distance.

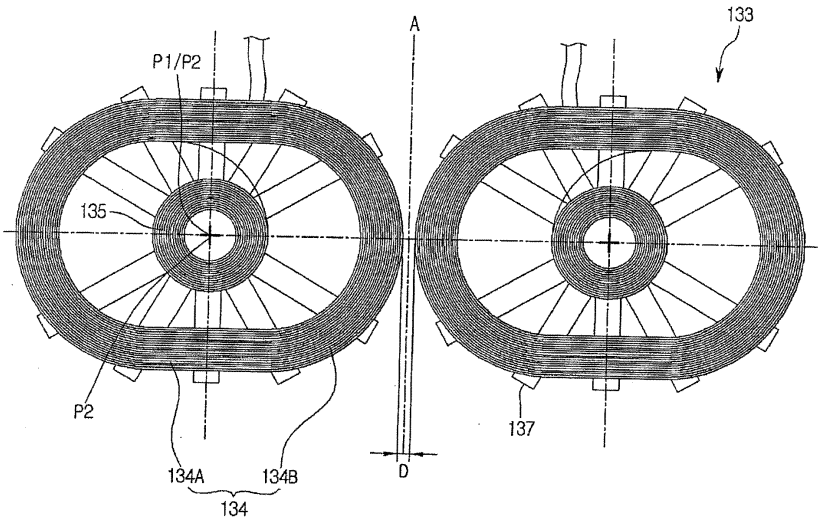

FIG. 2

EP 2 048 914 A1

Description

BACKGROUND

1. **Field**

[0001] The present disclosure relates to a cooktop having an induction heating element.

2. **Background**

[0002] A stovetop or a cooktop cooker may be a home appliance having heating elements designed for the purpose of heating items such as food or liquid, and the cooker heats the item by using heat sources such as gas and electricity. An electric cooker using electricity includes a heating member. The heating member may include an induction heating heater or element that cooks food by using heat generated from an eddy current loss and a hysteresis loss which are generated as an alternating magnetic field is applied to a cooking container.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The embodiments will be described in detail with reference to the following drawings in which like reference numerals may refer to like elements wherein:

[0004] Figure 1 is an exploded perspective view showing a cooker such as a cooktop or stovetop according to a first embodiment.

[0005] Figure 2 is a detailed plan view of the induction heating element and/or induction heater according to the first embodiment illustrated in Figure 1.

[0006] Figure 3 is a detailed plan view of the induction heating element and/or induction heater according to a second embodiment.

[0007] Figure 4 is a detailed plan view of the induction heating element and/or induction heater according to a third embodiment.

[0008] Figure 5 is a detailed plan view of the induction heating element and/or induction heater according to a fourth embodiment.

[0009] Figure 6 is detailed a plan view showing an arrangement of the ferromagnetic or ferrimagnetic material of the induction heating element and/or induction heater.

[0010] Figure 7 is a detailed plan view showing an arrangement of the ferromagnetic or ferrimagnetic material of the induction heating element and/or induction heater.

DETAILED DESCRIPTION

[0011] Figure 1 shows a cooker e.g., a stovetop or cooktop, and Figure 2 shows a detail plan view of the induction heating element and/or induction heater the first embodiment. The cooker may make up the top of the stove or may be built into a countertop. Further, a gas burner may be used instead of an electric heater.

[0012] Referring to Figures 1 and 2, a cooker includes a case 110, an electric heater 120, an induction heater 130, a power supply unit 140, an inverter 150, a control unit 160 and an upper plate 170. Various parts, such as the electric heater 120 and the induction heating heater 130, may be installed in the case 110. The case 110 may be insulated to prevent the heat of the electric heater 120 and/or the induction heater 130 from escaping.

[0013] The electric heater 120 may be provided in an inner rear end of the case 110. Since heat is generated by resistance heat of the electric heater 120, it is possible to cook food using a cooking container or vessel made of a non-metal or non-magnetic material, for example, a cooking container made of a ceramic material or a glass material. The electric heater 120 may include a heating member 121 to generate heat through electricity, and an insulator 123. The insulator 123 serves to prevent heat of the heating member 121 from transferring into the case 110. A spring for damping impact is provided between a bottom of the case 110 and a lower surface of the insulator 123. Alternatively, a gas burner may be used rather than the electric heater.

[0014] In induction cooking, heat is generated in two ways. In magnetic hysteresis, the rapidly oscillating magnetic field created via inductor coil when AC power is applied causes power in the magnetic field to be converted to heat in the magnet base of the cooking vessel due to hysteresis. The amount of heat produced is proportional to the area of the hysteresis loop. This source of heat may be typical 7% or less, and gives thereof a small amount of heat.

[0015] The primary source of heat is the current produced by the electric field (known as eddy current). The current has it greatest value in the base of the cooking vessel, and gradually decrease with a rate dependent on frequency and material properties (relative permeability and election conduction). When the current amplitude has decreased e^{-1} or 37% of its start value, its distance is called the skin depth. If the skin depth is one further of the thickness of the base of the cooking vessel, almost all eddy current has transformed to heat (e.g., 97%). The heat from the cooking vessel is transferred to the food by conduction, but very little heat is transferred to the actual cooktop.

[0016] The induction heater 130 includes a coil base 131, an inductor coil 133, a plurality of solids 137 of ferromagnetic or ferrimagnetic material and a mica sheet 139. The ferromagnetic material may be ferrites or alpha iron (a-Fe). The ferrimagnetic material may be YIG (yttrium iron garnet) and ferrites composed of iron oxide and other elements such as aluminum, cobalt, nickel, manganese and zinc.

[0017] The inductor coil 133, the solids 137 and the mica sheet 139 are located on the coil base 131. It may be provided in an inner front end of the case 110. The inductor coil 133 is installed on the coil base 131, and the inductor coil generates the alternating or oscillating magnetic field. The inductor coil 133 includes an outer coil 134 and an inner coil 135, as shown in Figure 2. The

outer coil 134 in the first embodiment may be formed as a closed curve having two (2) straight portions 134A and two (2) curved portions 134B, and coils are wound for several times. The straight portions 134A may extend parallel to each other. The curved portions 134B may be formed as a semicircle having the same diameter, and both ends of the curved portions 134B may be connected to both ends of the straight portions 134A.

[0018] The outer coil 134 may be symmetrical around a symmetric point P1. The outer coil 134 may be symmetrically arranged around a symmetric axis extending perpendicular to the straight portions 134A between the adjacent curved portions 134B. The outer coils 134 may be adjacently arranged in order to sufficiently transfer the alternating or oscillating magnetic field to a space between the inductor coils 133. This allows the cooking container in excess of the range of inductor coil 133, e.g., a portion corresponding to the space between the inductor coils 133 of the cooking container positioned along the adjacent inductor coils 133 to be heated by the alternating or oscillating magnetic field.

[0019] According to this embodiment, any one of the respective curved portions 134B of the outer coil 134 may be arranged adjacently to the symmetric axis A. The outer coil 134 may be positioned so that any one of the respective curved portions 134B is spaced apart at a specific interval, e.g., distance D. The distance D may be 1 mm ~ 3 mm.

[0020] An inner coil 135 may be disposed inside of the outer coil 134. The inner coil 135 may be formed by winding the wire several times in a shape of circle having a center P2 which may coincide with the symmetric point P1 of the outer coil 134. The coil constituting the inner coil 135 may be wound in the same direction as the outer coil 134. This may prevent the alternating or oscillating magnetic field formed in the inner coil 135 from being opposite to the alternating or oscillating magnetic field formed in the outer coil 134. The inner coil 135 may be substantially disposed with the outer coil 134.

[0021] The solid 137 of ferromagnetic or ferrimagnetic may serve to diffuse the alternating or oscillating magnetic field generated in the inductor coil 133. A solid 137 may radially extended from the center point of the outer coil 134. An end of the solid 137 may extend beyond the outer periphery of the outer coil 134. The solid 137 may be disposed between the coil base 131 and the inductor coil 133. The alternating or oscillating magnetic field is sufficiently transferred into a space between adjacent inductor coils 133 by the outer coils 134 and the solid 137 which are adjacently arranged.

[0022] The mica sheet 139 may be provided between the inductor coil 133 and the solid 137. The mica sheet 139 may prevent heat generated by the cooking vessel seated on top of the upper plate 170 based on the oscillating magnetic field by the induction coil 133 from transferring to the solid 137.

[0023] The power supply unit 140 and the inverter 150 supply the AC power source having a predetermined frequency to the inductor coil 133, e.g., the outer coil 134 and the inner coil 135. A controller 160 may be used to control the operation of the cooker. The controller 160 may be provided in the inner front end of the case 110 and adjacently arranged to the induction heater 130.

[0024] The upper plate 170 may be connected to the upper portion of the case 110, thereby substantially closing the inside of the case 110. The cooking container or vessel is seated on a top of the upper plate 170, the heat generated in the electric and induction heating heaters 120, 130 is transferred to the cooking container via the upper plate 170. On the upper plate 170, a plurality of markings or identification 171a-171d corresponding to the electric and induction heating heaters 120, 130 is provided to align the cooking container.

[0025] A user may place the cooking container on the induction heating heater 130 using the seat portion 171a of the upper plate 170. If the cooking container is relatively bigger than the inductor coil 133, the cooking container is seated along the seat portions 171a and 171b corresponding to the adjacent inductor coils 133.

[0026] If the user inputs the operation signal by operating the control unit 160, the power source supplied from the power supply unit 140 by the inverter 150 is supplied to the inductor coil 133 as an AC power source having a predetermined frequency. The cooking container is heated by the resistance heat due to eddy current and by the heat due to hysteresis loss, as the alternating or oscillating magnetic field generated in the inductor coil 133, e.g., the outer and inner coils 134, 135, and the heat is transferred to the item to be heated.

[0027] The outer coils 134 are adjacently arranged to each other, and the alternating magnetic field generated in the outer and inner coils 134, 135 is extended to the space between the induction heating heaters 130 by the solids 137. The cooking container, seated on the top of the upper plate 170 corresponding to the space between the induction heaters 130, is also heated, and thus, the food may be more efficiently cooked.

[0028] Figure 3 shows an induction heater according to a second embodiment, and Figure 4 shows an induction heater according to a third embodiment. As shown in Figures 3 and 4, the inductor coils 233, 333 may include outer coils 234, 334 and inner coils 235, 335. Circle centers P4, P6 of the inner coils 235, 335 may be disposed inside of the outer coils 234, 334 and they may be spaced apart from the symmetric points P3, P5 at a predetermined interval.

[0029] In the second embodiment, the circle center P4 of the inner coil 235 may be eccentric or offset to the symmetric point P3 of the outer coil 234 in an opposite direction to the symmetric axis A of the adjacent outer coils 234. In the third embodiment, the circle center P6 of the inner coil 335 may be eccentric or offset to the symmetric point P5 of the outer coil 334 in a direction toward the symmetric axis A of the adjacent outer coils 334.

[0030] In the second embodiment, the relatively in-

creased alternating or oscillating magnetic field may be generated in the area of the inductor coil 233, which is spaced apart from the symmetric axis A. The food may be more efficiently cooked by using the relatively small cooking container, e.g., the cooking container corresponding to the size of the inductor coil 233. In the third embodiment, the relatively increased alternating or oscillating magnetic field may be generated in the area between adjacent the inductor coil 333, which is adjacently arranged to the other inductor coil, e.g., the area which is adjacently arranged to the symmetric axis A. The food or item to be heated is more efficiently cooked or heated by using the relatively large cooking container, e.g., the cooking container more than the size of the inductor coil 333.

[0031] Figure 5 shows an induction heater according to a fourth embodiment, and Figure 6 shows a solid of ferrimagnetic or ferromagnetic material according to the fourth embodiment. An outer coil 434 and an inner coil 435 of an inductor coil 433 may be formed in an circular shape having the same circular center as the center point P7 of the same inductor coil 433. The inner coil 435 may be substantially disposed within of the outer coil 434, since the diameter of the outer coil 434 is relatively greater than that of the inner coil 435.

[0032] Referring to Figure 6, according to this embodiment, the solids of ferrimagnetic or ferromagnetic material 437 for magnifying the alternating or oscillating magnetic field of the inductor coil 433 may include a radial portions 437A, 437E-437H, shorter portion 437C and an extended portions 437B, 437D. The plurality of portions 437A-437H radially extended from the center point P7 so that they may be spaced apart at a predetermined central angle. The radial portions 437A, 437E-437H may extend until the portions cross the outer coil 434, and an end of each radial portion 437A, 437E-437H may extend beyond an outer periphery of the outer coil 434. The extended portions 437B, 437D may extend further than the radial portions 437A, 437E-437H, and may extend further than the outer coil 434 in a radial direction. The radial portion 437C disposed on the line L and provided to adjacent inductor coil 433, may be shorter than portions 437A, 437E-437H.

[0033] The alternating or oscillating magnetic field is diffused into a space between the adjacent inductor coils 433, where the alternating or oscillating magnetic field of the inductor coil 433 is not easily transferred, via the extended portions 437B, 437D. Therefore, the food may be more efficiently cooked by using the relatively large cooking container which is out of the range of the inductor coil 433.

[0034] Figure 7 shows an arrangement of the portions of ferromagnetic or ferrimagnetic material in accordance with another embodiment. A plurality of radial portions 537A-537H and a plurality of bridge portions 537I-537L may be provided. The radial portions 537A-537H may radially extend from the center point P7 so that they are spaced apart at a predetermined central angle. The bridge portions 537I-537L may connect with ends of the radial portions 537F, 537H, which are radially extended to the space between the adjacent inductor coils, to each other. The radial portions 537F-537H may be shorter than radial portions 537A-537E. The bridge portions 537I-537L may be disposed parallel to a line, which align with center points P7 of the adjacent inductor heaters.

[0035] The alternating or oscillating magnetic field may be more efficiently transferred into the space between the inductor coils by the bridge portions 537I-537L. The food in the relatively large cooking container which is greater than the inductor coil may be more efficiently cooked, since the alternating magnetic field is more efficiently transferred into the space between the inductor coils by the bridge portions 537I-537L.

[0036] The inductor coils may be adjacently arranged to each other so that they are space apart at a minimum distance D. The alternating or oscillating magnetic field is diffused into the space between the inductor coils by solids(s) or portions(s). Food or items to be heated may be more efficiently cooked or heated by using a relatively large cooking container which is out of the range of the inductor coil, i.e. the cooking container, disposed along the adjacent inductor coils. The alternating magnetic field may be diffused into the area, where the adjacent inductor coils are spaced apart, by extended portions. it may be possible to cook food or items more efficiently using a relatively small cooking container corresponding to the range of the inductor coil.

[0037] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0038] A cooker embodiment may include: a coil base; a plurality of inductor coils generating an alternating current magnetic field and provided on the coil base; and a plurality of ferrites to transfer the alternating current magnetic field of the inductor coils and provided on the coil base, wherein in a space between the inductor coils, the inductor coils are adjacently arranged to each other or the alternating current magnetic field is transferred by the ferrites. The inductor coils are respectively formed as a plane curve, which are adjacently arranged to each other. At least some of the ferrites is extended into a space between the inductor coils.

[0039] A cooker embodiment may include: a coil base; a plurality of inductor coils, which are provided with outer coils adjacently arranged to each other and inner coils disposed inside of the respective outer coils, generating

an alternating current magnetic field and provided on the coil base; and a plurality of ferrites transferring the alternating current magnetic field of the inductor coils and provided on the coil base in an overlapped manner with the inductor coils, wherein in a space between the inductor coils, the outer coils are adjacently arranged to each other or the alternating current magnetic field is transferred by the ferrites. The inner coil is disposed inside of the outer coil so that it is adjacently arranged to the other outer coils. The inner coil is disposed inside of the outer coil so that they are spaced apart from the other outer coil. Some of the ferrites is extended outside of the outer coils and provided in the space between the inductor coils.

[0040] A cooker embodiment may include a coil base; a plurality of inductor coils generating an alternating current magnetic field and formed as a plane curve having at least one long side and short side and provided on the coil base in an adjacently located relationship to each other; and a plurality of ferrites transferring the alternating current magnetic field of the inductor coils and provided on the coil base. The inductor coils are spaced apart in a range of 1 mm ~ 3 mm in order to insulate therebetween. The inductor coils are formed as a closed curve having 2 straight portions and 2 curved portions which connect both ends of the straight portions to each other.

[0041] A cooker embodiment may include a coil base; a plurality of inductor coils which are provided with outer coils provided on the coil base, and with inner coils provided on the coil base corresponding to an inside of the outer coils; and a plurality of ferrites transferring an alternating current magnetic field of the inductor coils and provided on the coil base, wherein the inductor coils are provided on the coil base such that the respective outer coils are adjacently arranged to each other. The outer coils are formed as a closed curve having 2 straight portions and 2 curved portions which connect both ends of the straight portions to each other. The outer coils are respectively formed as a closed curve having a symmetric center, and the inner coils are formed as a circle shape having the same circle center as a center point of the outer coil. The outer coils are respectively formed as a closed curve having a symmetric center, wherein the outer coils, which are adjacently arranged to each other, are provided on the coil base symmetrically about a straight line between the outer coils, and wherein the inner coils are respectively disposed inside of the outer coils such that they have a circle center spaced apart from the symmetric point of the outer coils.

[0042] A cooker may include a coil base; a plurality of inductor coils generating an alternating current magnetic field and provided on the coil base in an adjacently located relationship to each other; and a plurality of ferrites transferring the alternating current magnetic field of the inductor coils to a space between the adjacent inductor coils. The ferrite is a radial ferrite of which a plurality of ferrites are radially extended from the center point, and wherein the some of the radial ferrite which is extended into a space between the adjacent inductor coils is an extended ferrite which is further extended out of the inductor coils.

[0043] A cooker embodiment may include a coil base; a plurality of inductor coils generating an alternating current magnetic field and provided on the coil base in an adjacently located relationship to each other; and a ferrite, which is provided with a plurality of radial ferrites extending to a space between the adjacent inductor coils and at least one bridge ferrite connecting some of the radial ferrites radially extending to a space between the adjacent inductor coils, transferring the alternating current magnetic field of the inductor coils to a space between the adjacent inductor coils and provided on the coil base. The inductor coils comprise an outer coil provided on the coil base; and an inner coil provided on the coil base corresponding to the inside of the outer coil.

[0044] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art. Further, the teaching of the induction heater or induction heating element may be applicable to other areas other than home appliances. Further, the entire cooktop may comprise induction heaters without electric heaters or gas burners. Many configurations for different heaters are possible. Further, the solids or portions of ferromagnetic or ferromagnetic material may have shapes other than a rectangle or polygonal shape.

Claims

1. An induction heater comprising:

a base;
a plurality of first solids of ferromagnetic or ferrimagnetic material, the solids have a prescribed shape and are provided to have a prescribed arrangement on the base; and
a first coil having a plurality of wire windings, the first coil has a prescribed shape, the first coil is provided over at least portions of the plurality of solids.

2. The induction heater of claim 1, wherein the plurality of solids have a rectangular shape, and are arranged to radially extend outward the first coil, and cross the first coil.

3. The inductor heater of claim 2, wherein each end of the plurality of solids extend beyond the outer periphery of the first coil.

4. The inductor heater of claim 1, wherein a prescribed number of solids are at least one of longer or shorter than others.

5. The inductor heater of claim 3, wherein from a middle reference point of the first coil, the first coil and the plurality of first solids have symmetry.

6. The inductor heater of claim 1, further comprising a second coil provided within the first coil and spaced apart from the first coil, and the second coil cross over at least portions of the plurality of first solids.

7. The inductor heater of claim 6, wherein the second coil has circular shape, and the first coil has an oval shape.

8. The inductor heater of claim 7, wherein a middle reference point of the second coil is offset from a middle reference point of the first coil.

9. The inductor heater of claim 1, further comprises a plurality of second solids of ferromagnetic or ferrimagnetic material, the second solids are formed parallel to each other, and contact at least one of the first solids.

10. The inductor heater of claim 1, 2, 3, 4, 5 or 9, further comprising:

a plurality of third solids of ferromagnetic or ferrimagnetic material; and
a third coil having a plurality of wire windings, wherein
the third solids and third coil have the same shape and arrangement as the first solids and the first coil, respectively, and the first and third coils are separated from each other by a prescribed distance.

11. The inductor heater of claim 6, 7, or 8, further comprising:

a plurality of third solids of ferromagnetic or ferrimagnetic material; and
a third coil having a plurality of wire windings; and
a fourth coil, wherein
the third solids, the third coil and the fourth coil have the same shape and arrangement as the first solids, the first coil and the second coil, respectively, and the first and third coils are separated from each other by a prescribed distance.

Amended claims in accordance with Rule 137(2) EPC.

1. An induction heater comprising:

a base (131);
a plurality of first solids of ferromagnetic or ferrimagnetic material (137, 437), the solids having a prescribed shape and being provided to have a prescribed arrangement on the base (131); and
a plurality of inductor coils (133, 233, 333, 433) provided over at least portions of the plurality of solids, each inductor coil (133, 233, 333, 433) including a first coil (134, 234, 334, 434) having a plurality of wire windings,

wherein each first coil includes at least one curved portion, and curved portions are adjacently arranged in order to sufficiently transfer an alternating or oscillating magnetic field to a space between the curved portions.

2. The induction heater of claim 1, wherein the plurality of solids have a rectangular shape, and are arranged to radially extend outward the first coil, and cross the first coil.

3. The inductor heater of claim 2, wherein each end of the plurality of solids extend beyond the outer periphery of the first coil.

4. The inductor heater of claim 1, wherein a prescribed number of solids are at least one of longer or shorter than others.

5. The inductor heater of claim 3, wherein from a middle reference point of the first coil, the first coil and the plurality of first solids have symmetry.

6. The inductor heater of claim 1, wherein each inductor coil (133, 233, 333) includes a second coil provided in an inner side of the first coil and spaced apart from the first coil.

7. The inductor heater of claim 6, wherein the second coil has a circular shape, and the first coil has an oval shape.

8. The inductor heater of claim 7, wherein a middle reference point of the second coil is offset from a middle reference point of the first coil.

9. The inductor heater of claim 1, further comprising a plurality of second solids of ferromagnetic or ferrimagnetic material, the second solids being formed parallel to each other, and contacting at least one of the first solids.

10. The inductor heater of claim 1, 2, 3, 4, 5 or 9, wherein the first coil includes two straight portions and two curved portions, and the straight portions may extend parallel to each other.

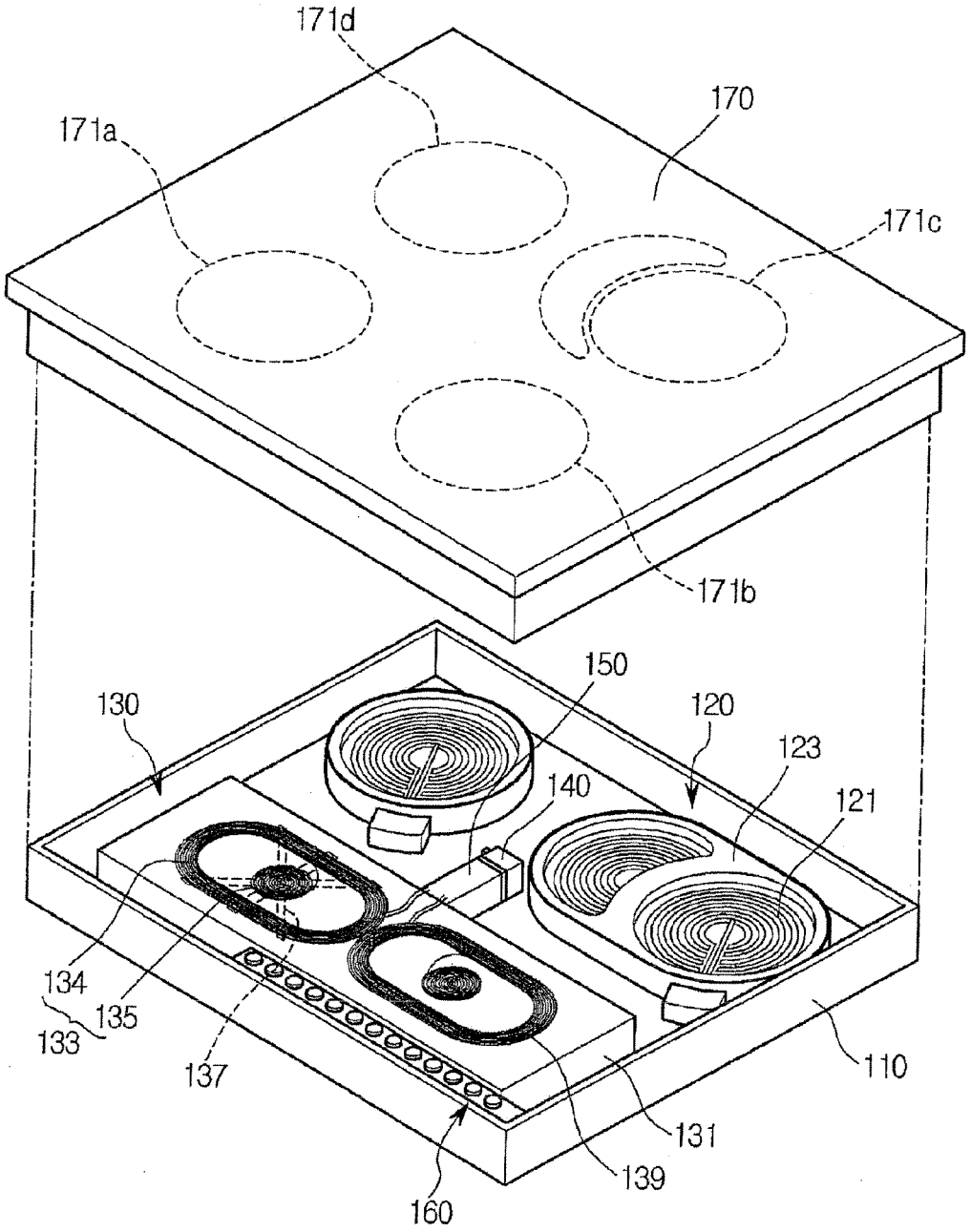
171d
170
171a
171c
171b
150
130
120
123
140
121
134
135
133
137
110
131
139
160

FIG.1

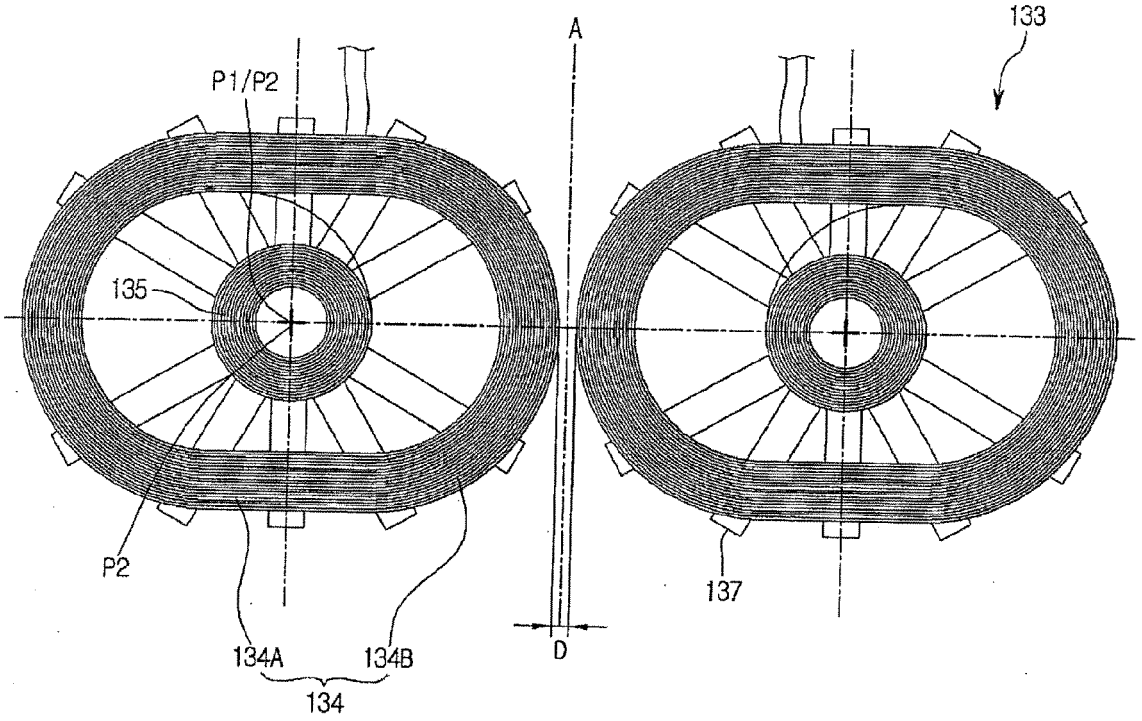

FIG.2

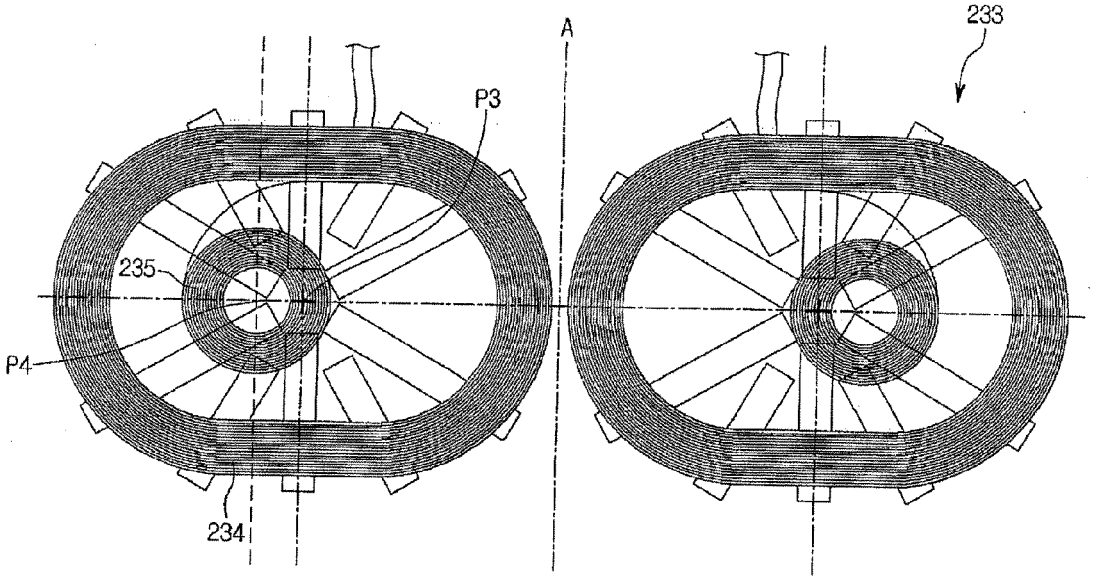

FIG.3

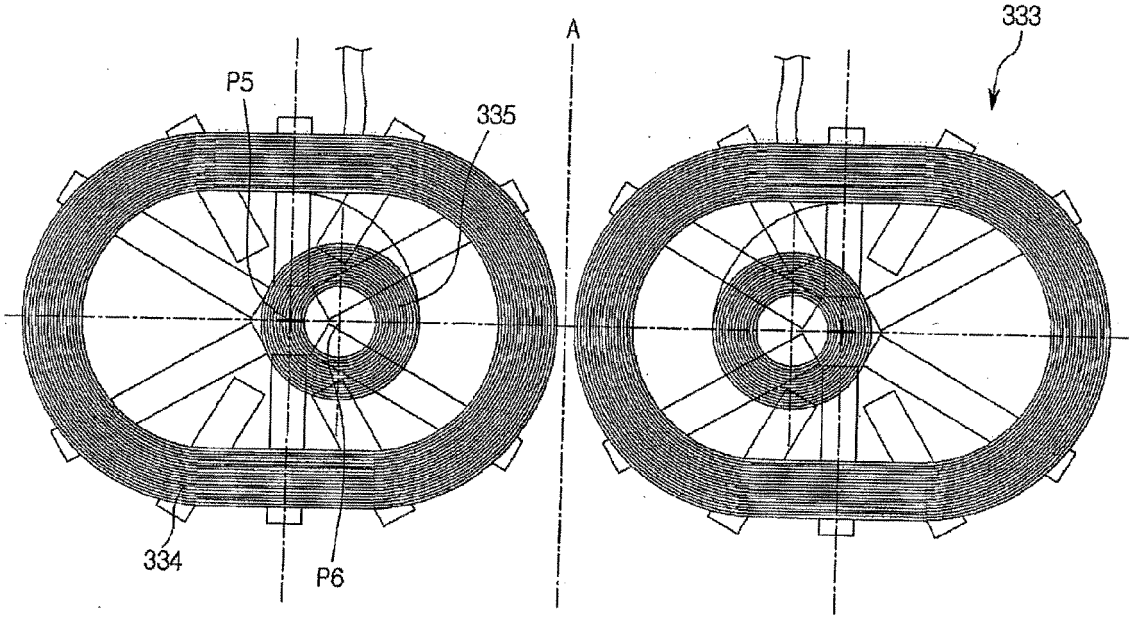

FIG.4

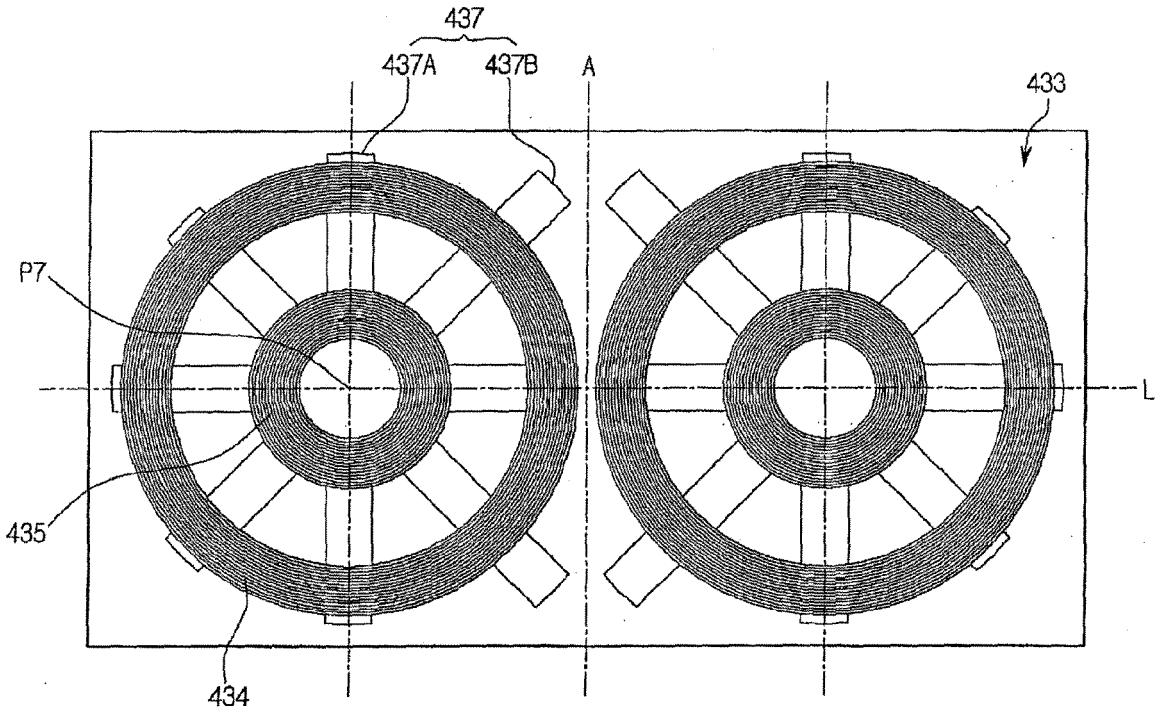

FIG.5

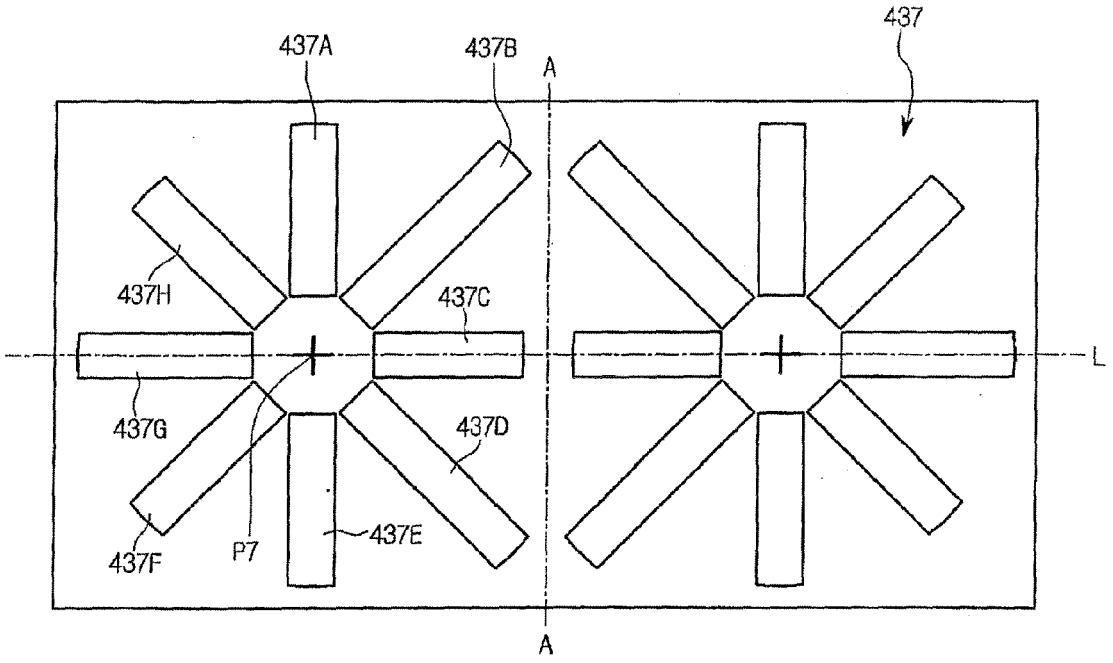

FIG.6

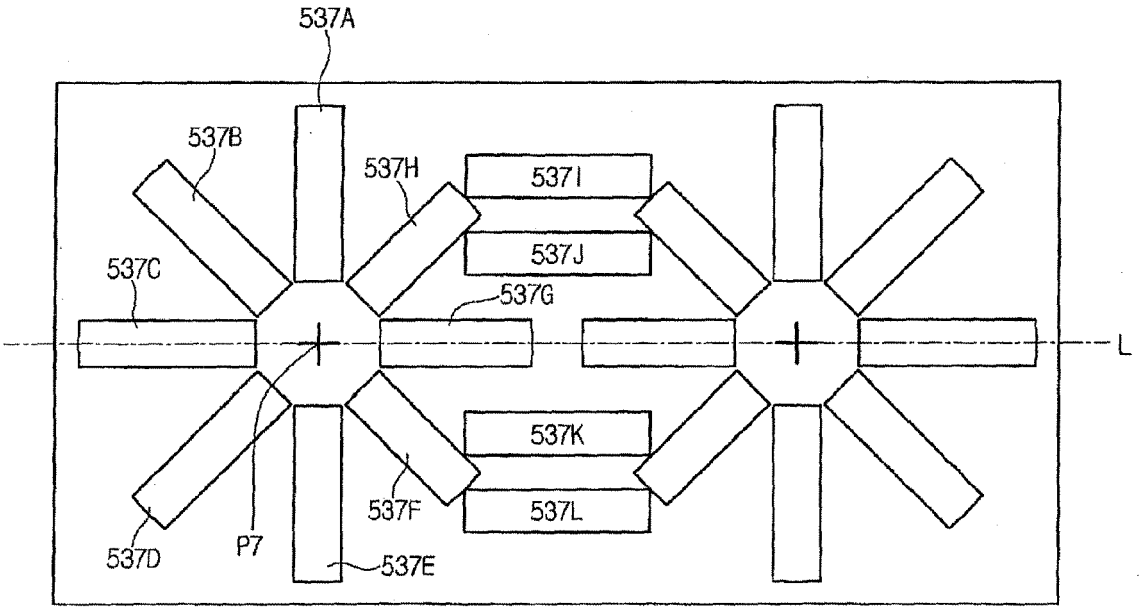
537A
537B
537H
537I
537J
537C
537G
L
537K
537F
537L
537D
P7
537E

FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 11 8254

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 657 486 A (BONNET SA [FR]) 26 July 1991 (1991-07-26) * figures 1-3 *	1-3,5,6	INV. H05B6/36 H05B6/12
X	GB 2 199 720 A (ELECTRICITE DE FRANCE ELECTRICITE DE FRANCE [FR]) 13 July 1988 (1988-07-13) * figures 4-7 *	1-8	
X	US 2005/242085 A1 (KAJI TETSUYA [JP] ET AL) 3 November 2005 (2005-11-03) * figures 22,23 *	1-3,5, 10,11	

TECHNICAL FIELDS SEARCHED (IPC)

H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 March 2008	Tasiaux, Baudouin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

2

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 11 8254

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-03-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2657486 A	26-07-1991	NONE	
GB 2199720 A	13-07-1988	BE 1006691 A3	22-11-1994
		CH 673368 A5	28-02-1990
		DE 3741909 A1	16-06-1988
		ES 2006035 A6	01-04-1989
		FR 2608348 A1	17-06-1988
		IT 1211585 B	03-11-1989
		JP 63155581 A	28-06-1988
		US 4792652 A	20-12-1988
US 2005242085 A1	03-11-2005	CN 1395059 A	05-02-2003
		FR 2827114 A1	10-01-2003
		KR 20030004086 A	14-01-2003
		US 2003006230 A1	09-01-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82